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ALLOY STEELS FOR USE AT ELEVATED TEMPERATURES

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1 Claim. (Cl. 75—128)

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This invention relates to alloy steels and to their use in the manufacture of power plant (or parts thereof) and other apparatus which in service is or may be required to operate in a range of temperature extending up to 850° C., and moreover may be subjected during such operation to considerable stress.

U. S. Patent No. 2,402,814 describes and claims alloy steels having a high resistance to creep at temperatures up to 800° and 850° C. The alloys described in this specification possess a very high degree of resistance to creep, but they fail eventually by a typical intergranular type of brittle creep failure.

It has now been found that alloys can be produced, which have much improved resistance to the brittle type of failure, and which show a considerable ductility, as measured by the reduction of area of a specimen fractured under creep conditions at high temperatures.

The alloys having these improved properties form the subject of the present invention, and have the following range of composition:

	Per cent
Carbon	up to 1.5
Silicon	up to 2.0
Manganese	1.0–10.0
Chromium	12.0–20.0
Nickel	15.0–35.0
Molybdenum	1.5– 6.0
Columbium	1.0– 5.0
Cobalt	4.0–40.0
Iron, remainder	

The preferred range of composition is as follows:

	Per cent
Carbon	0.1– 0.3
Silicon	1.0– 2.0
Manganese	2.5– 3.5
Chromium	12.0–16.0
Nickel	16.0–20.0
Molybdenum	2.5– 3.5
Columbium	1.5– 2.5
Cobalt	6.0– 8.0
Iron, remainder	

After suitable solution and precipitation heat-treatments, an alloy with a composition within the preferred range of analysis gave the following extension after testing at 650° C. at a stress of 10 tons/sq. in.:

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0.1% in 1000 hrs.

As an example of the increased ductility, an alloy with a composition within the preferred range which was fractured in 633 hours under a load of 14.0 tons/sq. in. at 650° C. gave a reduction of area at the point of fracture in excess of 40%. There was also complete freedom from the characteristic intergranular creep cracks even in the necked portion of the test piece.

From the above figures it will be seen that alloys within the range of composition according to the invention have a high resistance to creep with a high ductility, and are particularly suitable for the blades, rotors or other highly stressed components of gas turbine or other power plant or mechanical parts, particularly in those cases where the shape of the component necessitates the use of stress-raising changes of section such as sharp fillet radii or re-entrants or other notches.

We claim:

A creep-resisting alloy steel having a composition within the following ranges:

	Per cent
Carbon	0.1– 0.3
Silicon	1.0– 2.0
Manganese	2.5– 3.5
Chromium	12.0–16.0
Nickel	16.0–20.0
Molybdenum	2.5– 3.5
Columbium	1.5– 2.5
Cobalt	6.0– 8.0
Iron, remainder.	

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